



County of Orange
California

Gary Simon
Executive Director

MCAS El Toro
Local Redevelopment
Authority

10 Civic Center Plaza
Second Floor
Ana, California
2701-4062

Tel: (714) 834-3000
Fax: (714) 834-6120

M60050_003498
MCAS EL TORO
SSIC NO. 5090.3.A

October 3, 2001

Mr. Dean Gould
BRAC Environmental Coordinator
Marine Corps Air Station El Toro
P.O. Box 51718
Irvine, CA 92619

Subject: Technical Memorandum, Verification of Perchlorate at IRP Site
1 – Explosive Ordnance Disposal Range

Dear Mr. Gould:

Thank you for the opportunity to review the subject Technical Memorandum. Section 2 of the document indicates that the Department of the Navy (DON) will perform a Phase II Remedial Investigation (RI) to further evaluate perchlorate distribution at MCAS El Toro. The El Toro Local Redevelopment Authority (LRA) concurs with DON's decision and recommends that the issues raised in the attached memorandum from the LRA consultant, GeoSyntec Consultants, be addressed in the Phase II RI.

If you should have any questions, please feel free to call Polin Modanlou of my staff at (949) 262-0423.

Sincerely,

Gary Simon, Executive Director
El Toro Local Redevelopment Authority

Encl.

cc: Ms. Nicole Moutoux, USPEA Region IX
Ms. Patricia Hannon, CRWQCB Santa Ana Region
Ms. Triss Chesney, DTSC Southern California Region
Mr. Steve Sharp, OCHCA

received
10/16/01

M E M O R A N D U M

TO: Polin Modanlou, MCAS El Toro Local Redevelopment Authority

FROM: Peter Dollar, P.E., GeoSyntec Consultants
Bertrand S. Palmer, Ph.D., P.E., GeoSyntec Consultants

DATE: 1 October 2001

SUBJECT: Preliminary Review of Technical Memorandum
Verification of Perchlorate at IRP Site 1,
Explosive Ordnance Disposal Range
Marine Corps Air Station, El Toro
Orange County, California

1. INTRODUCTION

GeoSyntec Consultants (GeoSyntec) performed a preliminary review of the document titled, "Technical Memorandum, Verification of Perchlorate at Installation Restoration Program (IRP) Site 1, Explosive Ordnance Disposal Range, Marine Corps Air Station, El Toro, California" dated July 2001 (Technical Memorandum), prepared by Earth Tech, Inc. (Earth Tech) for the Department of the Navy/United States Marine Corps (DON/USMC).

The Technical Memorandum presents the results of an evaluation of perchlorate in soil and groundwater at IRP Site 1 and addresses some of the regulatory comments on the *Draft Report, Evaluation of Perchlorate in Groundwater* issued by DON/USMC in 1999. This Technical Memorandum provides information regarding the nature and extent of perchlorate in groundwater, supplemental data regarding local hydrogeologic conditions, and indications of potential perchlorate presence in soil.

2. BACKGROUND

The information presented in this section is based on information reported in the Technical Memorandum by DON/USMC.

Site 1 was the former explosive ordnance disposal (EOD) range. It is situated within a tributary canyon of Borrego Canyon Wash. Military ordnance was used in training at the site, as well as civilian and commercial explosives such as trinitrotoluene (TNT), dynamite, and plastic and gelatinous explosives confiscated by Orange County Sheriff's Department. Munitions were detonated in trenches and pits at the site. In 1982, approximately 2,000 gallons of sulfur trioxide chlorosulfonic acid were reportedly burned in trenches located in the northern portion of the site. An estimated 300,000 gallons of petroleum fuels were used during training exercised from 1952 through 1993. Perchlorate was also identified as a potential contaminant of concern at Site 1 due to its use in explosives and propellants.

In December 1997, perchlorate was identified at low concentrations (<8 micrograms per liter [$\mu\text{g/L}$]) in groundwater downgradient from MCAS El Toro during sampling conducted by the Orange County Water District. Since December 1997, a number of investigation were conducted by DON/USMC to evaluate perchlorate at MCAS El Toro. The results of these investigations were summarized in the Draft Evaluation of Perchlorate in Groundwater Technical Memorandum prepared by DON/USMC in 1999.

Following their review of the Draft Evaluation of Perchlorate in Groundwater Technical Memorandum, the regulatory agencies requested that an additional evaluation including installation of additional wells to confirm the groundwater flow magnitude and direction, and collection of groundwater samples from wells screened across the water table for perchlorate analysis be performed at the site.

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Based on the results of the additional evaluation presented in the Technical Memorandum, DON/USMC concluded the following regarding the presence and impact of Perchlorate at the Site:

- The presence of perchlorate was confirmed, with perchlorate being detected in one groundwater sample in excess of the state and federal Action Levels of 18 $\mu\text{g/L}$ and 32 $\mu\text{g/L}$, respectively.
- Perchlorate in groundwater at concentrations exceeding the state and federal Action Levels is localized near Well MW201. Perchlorate was detected at a concentration of 324 $\mu\text{g/L}$ in monitoring Well 01_MW201. Perchlorate was also detected at 7 $\mu\text{g/L}$ (the reporting limit is 4 $\mu\text{g/L}$) in monitoring Wells 01_MW207 and 01_DGMW58, below the state and federal Action Levels of 18 $\mu\text{g/L}$ and 32 $\mu\text{g/L}$, respectively. Perchlorate was not detected in the nine remaining wells, including the closest wells located upgradient and downgradient of 01_MW201. Additional sampling of existing wells and further characterization of the lateral extent of perchlorate in groundwater will be performed as part of the Phase II Remedial Investigation (RI).
- Groundwater flow is toward the south-southwest with a calculated groundwater velocity at the downgradient boundary of IRP Site 1, of 0.05 feet per day (less than 1.4 feet per year).
- Perchlorate was detected in soil at shallow depths (less than 5 feet); however, the concentrations were less than the residential or industrial preliminary remediation goals. Comprehensive sampling and assessment of the geophysical anomalies will be conducted in the forthcoming RI.

- The general groundwater chemistry at IRP Site 1 was consistent with the general chemistry of groundwater at IRP Site 2, located hydraulically downgradient of IRP Site 1.

3. DISCUSSION

As indicated in Section 2, DON/USMC will perform a Phase II RI to further evaluate perchlorate distribution at MCAS El Toro. GeoSyntec concurs with this decision and recommends that the following issues be addressed in the Phase II RI.

Issue No. 1

During previous phases of investigation, several wells were found to contain perchlorate. DON/USMC installed six new wells in the vicinity of the known perchlorate-containing wells to further characterize the distribution of perchlorate in groundwater. The vertical extent of perchlorate in groundwater was not investigated and no nested wells have been installed at the site. The monitoring wells have screens that range in length from 20 to 40 feet, and the water quality could be very different depending on the interval from which the bulk of the water sample is obtained. Additionally, the new wells taken in combination with the existing wells do not provide sufficient aerial separation for the proper triangulation of water level measurements to assess flow directions.

Moreover, the fact that five of the six new wells did not contain measurable concentrations of perchlorate does not necessarily indicate that the perchlorate has not migrated far (as asserted by DON/USMC), particularly if the wells are not located downgradient or along preferential flow paths from locations where perchlorate has been detected (see additional comments regarding groundwater flow directions and preferential flow in Issues No. 3 and 4 below). For example, monitoring well 01-MW207 could be either transgradient or downgradient of 01_DGMW58 based on the inferred flow direction contours plotted on Figure 4-3 in the Technical

Memorandum and the water level data presented. [See Technical Memorandum at Page 4-9].

The Technical Memorandum conclusions state that "additional sampling of existing wells and further characterization of the lateral extent of perchlorate in groundwater will be performed as part of the Phase II RI." This work should include installing wells to the east and west of the wells installed along the main axis of Site 1.

Issue No. 2:

Soil samples were collected from the surface at three topographically low lying locations: from depths of about 1 foot and 4 feet below ground surface (ft bgs); at 14 geophysical anomalies; and from greater depths (5 to 35 ft bgs) at each of the six new boreholes completed as monitoring wells. The fact that only four positive detections of perchlorate were found in 42 soil samples does not necessarily demonstrate that no perchlorate sources are present, since the study could have missed potential perchlorate sources outside of the study area. The source of the perchlorate found in groundwater samples collected from well 01-MW201 appears to remain unknown.

GeoSyntec believes that potential source areas should be defined. There is sparse information provided in the background related to site use. Additional investigation should be conducted to collect information regarding the method by which perchlorate may have entered the subsurface at Site 1, the amount of perchlorate that may have entered the subsurface, and information regarding the timing and location of entry. For example, the inferred correlation between geophysical magnetic anomalies and potential perchlorate sources is not explained. Source characterization is required to assess if there is a continuing source of perchlorate to groundwater.

Issue No. 3:

The evaluation of the magnitude and direction of the hydraulic gradient requires additional characterization. The data used to estimate the magnitude of the gradient along the valley axis based on regional topographic dip appear to be generally appropriate as a first estimate. However, the regional gradient and groundwater flow on the flanks of the valley require further assessment. Additional wells or piezometers should be installed to provide this information. Other available water level data from locations beyond the Site 1 boundaries should be used to extend the piezometric contours. Only water level data for 14 February 2001 are presented in detail in the Technical Memorandum. GeoSyntec believes that these data should be compared against previous data to assess temporal changes in groundwater flow conditions beyond the simple comparison to water level in 1999 [see Technical Memorandum at Page 4-2]. No nested wells are available to assess vertical hydraulic gradients. DON should consider collecting information required to assess vertical flow in long screen wells (for example, by using a borehole flow meter, if appropriate).

Issue No. 4:

Evaluation of perchlorate migration in groundwater requires additional work. The average linear groundwater velocity has been estimated based on approximate values of bulk hydraulic conductivity, horizontal hydraulic gradient, and effective porosity – all of which appear to contain a significant range of uncertainty. The groundwater velocity should be assessed using alternative methods (for example, using borehole dilution tests, if appropriate) to confirm these estimates.

Based on the average linear groundwater velocity of 0.3 feet per day presented in the Technical Memorandum, groundwater travels on the order of 10 feet per year or 100 feet per decade are attainable. Depending on when the perchlorate entered the subsurface, it may have traveled a significant distance. The actual distance that the perchlorate has migrated also will be affected by the rate at which natural attenuation may be taking place. Parameters such as oxidation-reduction potential and presence of electron donors should be used to estimate in situ biodegradation rates. The

role that faults, fractures and other preferential flow paths may play a role in the migration of perchlorate requires further assessment and comment as well.

In addition, it is possible that other chemical parameters of analysis in the groundwater samples (e.g., other anthropogenic chemicals such as VOCs) could be used as tracers to characterize the chemical migration at the site more completely.

Issue No. 5:

An assessment was performed to compare data from Site 2 (downgradient of Site 1) to Site 1. A Piper trilinear diagram has been prepared for select wells from Site 1 and Site 2, and the report concludes that general groundwater quality is similar at the two sites.

The objective and benefit of this comparison are not clear. For this comparison to be of more value, parameters with signatures that are expected to be different from background water quality are required. GeoSyntec believes that background information for Site 1 should be reviewed to determine which constituents are likely to create differences between Site 1 groundwater from groundwater in the surrounding area.

Issue No. 6:

GeoSyntec believes that a conceptual model that incorporates the following information should be developed for the site:

- Site geologic/hydrogeologic conditions;
- The chemical source characteristics;
- The nature and extent of chemical effects; and
- Fate and transport.

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The conceptual model can be used as a framework to test hypotheses and collect additional data to fill data gaps and reduce uncertainty. For example, geologic/hydrogeologic cross sections that provide additional differentiation within and between the stratigraphic units and structural controls (e.g., preferential pathways) would be useful for the development of conceptual models. At present, the geology is only subdivided into two categories (sand, silt and clay; and sandstone and siltstone).

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